Local Research
And Development Results

January 2003

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Local Research and Development Results – January 2003

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Department of Agriculture WA Wheat CVT

Aim: To compare the performance of wheat varieties in the M2 rainfall zone.

Research Officer: Tim Borgward
Company: Wesfarmers Landmark

Farmer: Graham Barnes
Location: Kenney Road, Wubin

Background: Research to find new and better performing wheat varieties.

Trial Details:

Plot size and replication	1.6 x 20m Plots - Triple Replicated
Soil type	Red Loam
Sowing date	18th June
Conditions at sowing	Reasonable Soil Moisture
Machinery	Knife Points and Press Wheels
Seeding rate	75 kg/ha
Fertiliser	Agstar @ 80 kg/ha / Urea @ 50 kg/ha
Herbicides and Insecticides	Pre - Trifluralin @ 1.5 L/ha Logran @ 35 g/ha Post - Monza @ 25 g/ha DC-Trate @ 1%

Results:

Variety	%age Protein	%age Screening	Hecto Weight	%age of Untreated	Yield kg/ha
Wyalkatchem	14.80	1.82	80.90	100%	652.64
Arrino	16.30	2.19	80.10	85%	557.90
Brookton	14.20	3.65	82.18	82%	534.05
Cadoux	15.10	2.04	81.10	75%	492.16
Calingiri	15.10	4.03	79.82	59%	382.78
Carnamah	15.40	1.74	79.00	65%	424.48
Eradu	16.40	1.49	82.82	77%	504.53
H45	14.80	6.87	79.76	102%	665.10
Halberd	15.40	6.05	78.56	61%	395.78
Stiletto	15.40	3.52	81.60	77%	505.67
Stylet	15.20	3.14	81.92	83%	541.15
Westonia	14.90	3.87	78.36	77%	503.74
Yitpi	16.00	2.89	78.64	65%	423.19
WAWHT2281	15.50	4.89	81.28	107%	695.73
WAWHT2454	14.20	2.91	82.28	93%	609.59
WAWHT2530	14.50	4.33	80.36	90%	585.89
WAWHT2531	14.90	4.16	77.76	86%	564.52
WAWHT2549	15.90	1.61	79.30	76%	497.87
WAWHT2468	15.50	3.04	82.18	72%	472.61
WAWHT2404	15.40	1.97	83.10	92%	603.21
WAWHT2405	14.70	2.53	84.54	76%	497.90

Interpretations/Comments: The 2002 season was one of the worst on record in the Dalwallinu Shire. When interpreting these results this must be taken into account. A variety such as Calingiri that has performed extremely well in recent times, really did not perform in a season where the growing season rainfall was a mere 134 mm's. The same can be said for Carnamah, Yitpi and even Halberd (which have all yielded in the top 20% of varieties the previous two years).

The other point to make is that the co-efficient of variation is reasonably high - at 19.87, this is approximately five above what is considered to be an effective co-efficient of variation. In short, this means that the variation in yields between the replicates of the same variety was not consistent enough.

Summary:

- Bonnie Rock (WAWHT2281) is showing promise as a new high yielding variety for the Medium to Low rainfall zones.
- The yields reflected the season in that the highest yielding variety (Bonnie Rock), only yielded 695 kg/ha. The growing season rainfall was only 134 mm's with no real opening or finishing rainfall event.
- Protein was unusually high for most varieties, with screenings averaging around 1 - 4%. Hectolitre weights were generally reasonable. These quality aspects were typical for the 2002 season - differences can be attributed to different varieties and their length to maturity.
- Wyalkatchem has again performed reasonably well as the 3rd highest yield. It was also the 3rd highest yielder in the CVT conducted at Dalwallinu in 2001 - which suggests that it can yield consistently well in a range of conditions.
- As with the 2000 and 2001 seasons, the results of this CVT are data for an unusually dry year, and should be treated as such. In an average season, the results between varieties would more than likely be very different.

Barley Agronomy for the Western Region

Aim: Evaluate the response of eighteen barley lines for grain yield, grain quality and malting quality to changes in soil pH (due to liming).

Research Officer: Blakely Paynter
Company: Department of Agriculture, Northam

Farmer: Neil and Kim Diamond
Location: West's Road, Buntine

Background: Over the last three years (1999 to 2001), the department has tested a number of crossbreds and named lines with reputed tolerance to soil pH and/or Al toxicity at two sites (Kalannie and Carabin) in the eastern wheatbelt. A number of lines from the NSW Department of Agriculture barley breeding program have consistently out yielded Stirling at these low pH sites by between 10% to 30%. One of the lines, Yambla, however has failed to show a yield advantage over Stirling on sites where soil pH is not considered to be limiting yield. The yielding ability of other lines exhibiting tolerance has not been tested outside those two environments.

A biplot comparison of all the cultivars sown in acid soil CVT trials in 2000 and 2001 for grain yield (kg/ha) in relation to an ideal cultivar was conducted. The ideal cultivar is defined as having the highest yield in all acid soil CVT trials (high grain yield and stable yield). The cultivars are ranked based on their distance from this ideal cultivar (concentric circles help ranking). The biplot comparison explains 88% of the variation in grain yield.

(Please note: biplot comparison diagram is documentated under the "Local R&D Results 2002" section of the Liebe website).

The lines sown with reputed tolerance to acid soils included WB223, WB229, WB230, WB240, W92%794, Yambla and Brindabella. WB229 was the highest yielding and most stable cultivar. The next highest yielding variety was WB223. WB240 was lower yielding than WB223 but it was less variable in its grain yield than WB230.

Of the lines with no reputed tolerance to acid soils, the highest yielding was Molloy (with similar but more stable yield than the acid tolerant lines WB230, W92%794 and Yambla). The analysis suggests that Brindabella and Schooner were the worst cultivars on acid soils and Stirling and Hamelin show very little adaptation to acid soils.

These low pH CVT sites used however represent a low proportion of the soil types on which barley is traditionally sown. Barley yields in Western Australia could benefit from a crossing program that incorporates these lines with tolerance to low soil pH and/or Al toxicity if they show a yield benefit on soils which are marginal for their response to lime. These soils would be where soil pH is above 4.5 to 5.0. On these soils, a small yield benefit could have a significant impact on the ability of barley varieties to produce more reliable grain size, as low soil pH and Al toxicity restrict root growth.

The yield advantage of the best performing lines in the low pH CVT trials has not been evaluated on soils with different soil pH. One way of testing the genetic ability of these lines is to sow them on a site that has been previously limed. This removes confounding effects of soil type and climatic conditions.

Trial Details:

Plot size and replication	15m long x 7 rows (22cm spacing) 18 varieties x 3 lime rates x 3 replicates Lime applied in 1996: 0, 1 and 2 t/ha on a long term lime demonstration site.
Soil type	Brown sandy earth
Sowing date	11th June 2002
Conditions at sowing	Dry
Machinery	No till with press wheels
Seeding rate	Target - 150 plants/m^2
Fertiliser	50 kg N/ha, 30 kg P/ha and 40 kg K/ha at seeding
Paddock History	2001 = pasture, 2000 = wheat, 1999 = lupins, 1998 = wheat, 1997 = lupins, 1996 = wheat

Results, Interpretations and Comments:Table 1. Soil pH ($CaCl_2$) and Aluminium levels ($CaCl_2$) at 10cm intervals of the site in 2002 with no lime and either 1 or 2 t/ha lime applied in 1996.

Soil depth (cm)	Lime applied in 1996		
	0 t/ha	1 t/ha	2 t/ha
	a) Soil pH ($CaCl_2$)		
0-10	4.2	6.1	6.4
10-20	3.9	4.7	4.6
20-30	4.2	4.8	4.7
30-40	4.8	5.1	5.0
40-50	5.2	5.4	5.3
	b) Al ($CaCl_2$) (mg/kg)		
0-10	3	<1	<1
10-20	6	<1	<1
20-30	1	<1	<1
30-40	<1	<1	<1
40-50	<1	<1	<1

The residual value of either 1 or 2 t/ha of lime applied in 1996 was still evident in 2002 with soil pH increased by nearly 2 pH units at the surface (top 10cm) and 0.5 pH units between 20-30cm depth (Table 1). There was no effect of lime application on soil pH at 40-50cm depth. These results indicate that there has been some lime movement and increase in soil pH to 30cm depth since the year 2000. Aluminium levels in the top 20cm of the nil lime treatment are toxic to root growth in barley.

Table 2. Grain yield (t/ha) of 18 cultivars of barley with no lime applied and either 1 or 2 t/ha lime applied in 1996 (REML data from reps 2 and 3).

Variety	Reputed acid soil tolerance	Lime applied in 1996		
		0 t/ha	1 t/ha	2 t/ha
Stirling	No	0.64	0.87	1.11
Gairdner	No	0.63	0.67	1.43
Hamelin	No	0.76	1.19	1.42
WABAR2109	No	0.76	1.27	1.45
Baudin	No	0.65	0.93	1.24
WABAR2147	No	0.56	1.11	0.95
WABAR2175	No	0.67	0.78	1.29
WB223	*Yes*	0.55	0.99	1.50
WB229	*Yes*	0.57	0.81	1.20
WB230	*Yes*	0.53	1.00	1.25
WB240	*Yes*	0.49	0.86	1.04
W92%794	*Yes*	0.87	1.25	1.71
Yambla	*Yes*	0.33	0.82	0.77
Mundah	No	0.63	1.15	1.57
Molloy	No	0.73	1.27	1.41
Skiff	No	0.67	1.20	1.39
Brindabella	**Yes**	0.46	0.75	1.18
Schooner	No	0.73	1.05	1.29
Mean grain yield (t/ha)		**0.62**	**1.00**	**1.29**

The barley crop was sown on 11th June into a dry seedbed with an average of 146 plants/m^2 being established in each plot. Weed control at the site was poor with no effective pre-sowing or post-emergent ryegrass control. There was also significant variability in plant growth between replicates due to a change in soil type over the length of the trial site. The soil type changed from a shallow gravel in rep 1 to deeper sand in rep 3 with little or no surface gravel. Plant height ranged from 27cm in rep 1 to 39cm in rep 3. Data was analysed with spatial analysis to compensate for this variability in the site and data from rep 1 removed from the analysis.

One of the aims was to determine if lines with reputed tolerance to acid soils performed differently once lime was applied. A graphical biplot representation of the grain yields is illustrated on the Liebe website. The analysis of variance suggests that there was no significant interaction between lime application and cultivar performance.

Of the NSW barley lines with reputed tolerance to acid soils only one showed superior grain yield in this trial. The best performing line was W92%794. The previous good performance of WB223, WB229 and WB240 on acid soils was not observed.

W92%794 was the highest yielding and least variable of the cultivars sown. Molloy, WABAR2109, Skiff and Hamelin were as good as W92%794 with nil and 1 t/ha lime and slightly lower yielding than W92%794 with 2 t/ha lime. Brindabella was again one of the worst performing cultivars with Yambla the worst line (primarily due to its very late maturity). The provisional malting lines - Hamelin and Baudin - performed better than Stirling for grain yield regardless of soil pH.

Summary:

- Response of barley lines in this trial was different to what was expected based on past performance in acid soil CVT trials.
- The yield of barley on this site (surface pH of 4.2 and Al levels of 3 mg/kg) was nearly doubled with the addition of lime (from 0.6 t/ha to between 1.0 and 1.2 t/ha with lime). The interaction between lime and variety was not significant suggesting that all barley lines responded similarly to the change in soil pH caused by lime application.
- This research looking at the acid tolerance of barley lines on soils that have been limed will be continuing for another two seasons.
- Crosses have been made to a number of the acid tolerant NSW barley lines with Kaniere or FM37 as parents to improve the acid soil tolerance of malting barley cultivars adapted to the Western Australian environment.
- All the cultivars sown in this trial were sown at four other sites around Western Australia to test their yield performance in different environments (02NO1 AV_1, 02NO2 LG_1, 02WH54 and 02GS80). Unfortunately a similar trial to this one at Holt Rock (02NO2 LG_1) was aborted due to seasonal conditions. The results from this trial will be combined with data from the three remaining sites to provide a more complete analysis.

Acknowledgments:
This research is funded by the Department of Agriculture and GRDC (DAW00059). Technical assistance was undertaken by Bethany Lauk and Peta Dunkerton. Trials were sown and harvested by the Geraldton Research Support Unit. The support of the Diamond's in allowing us to conduct this research is much appreciated. Mario D'Antuono provided statistical assistance.

Flexi-N Timing

Aim: Compare Flexi-N timing especially for late protein boost application in wheat.

Research Officer: Troy Conley & Luigi Moreschi
Company: CSBP

Farmer: BA Shaw & Co.
Location: Liebe Main Trial Site, Buntine

Background: Flexi-N is continuing it's widespread acceptance throughout the wheat growing regions of the state due to the advantages it has to offer including,

- Greater in paddock efficiencies ie. Split applications of N without adding an extra pass
- More accurate application
- Reduced volatility
- Ability to 'play the season' with N application

Trial Details:

Plot size and replication	20m*1.8m * 3 reps
Soil type	Gravelly Loamy Sand
Sowing date	12th June 2002
Conditions at sowing	Dry
Machinery	Conserva Pak 9" spacings
Seeding rate	70 kg Carnamah
Fertiliser	Basal 113 kg/ha Agflow + 40 kg Potash
Herbicides and Insecticides	1 L/ha Treflan + 35 g/ha Logran
Paddock History	2001 = Poor pasture , 2000 = Wheat

Results: Due to the dry season there was insufficient grain to harvest. Tissue tests taken at late tillering indicated low nitrogen uptake on all treatments (even the + N treatments), due to the reduced availability of the nitrogen at the root surface because of the poor soil moisture conditions. Soil test taken in November showed a good correlation between applied N in 2002 and the level of N in the soil.

	Plot 1	Plot 2	Plot 3	Plot 13	Plot 20	Plot 19
Treatment – Flexi-N	Nil	50 L/ha	100 L/ha	Nil	50 L/ha	100 L/ha
Nitrate mg/kg	9	9	14	11	11	14
Ammonium mg/kg	6	12	26	5	13	19
Approx. kg of N / ha	24	34	64	26	38	53

Interpretations/Comments: These results show a strong trend towards N applied and what is remaining in the soil after the failed wheat crop.

We hope to continue monitoring the N levels at the site and measure a carryover response in 2003.

Elders Resistance Boom Results 2002

Aim: To assess the effectiveness of a range of herbicides on a number of ryegrass populations throughout the 'Liebe' area with an 'in situ' method of resistance testing.

Research Officer: Shannon Hunt & Brett Beard
Company: Elders Limited

Elders Merchandise

Background: The level of herbicide resistance testing by farmers is extremely low due to a number of factors including the cost of testing, the variability of results obtained from testing and the practicalities of the test results. The Elders Resistance Boom was developed to provide a faster, cheaper, flexible and more accurate method of resistance testing. The boom can be set up to test the resistance profile of any weed with a range of chemical groups, with the results immediately useful to the farmer.

Trial Details:

Plot size and replication	6 x 2m wide plots, 25m length
Herbicide Treatments	Targa 300 mL/ha + 0.75% Uptake
	Sertin 500 mL/ha + 0.75% Uptake
	Aramo 300 mL/ha + 1% Hasten
	On Duty 40 g/ha + 0.5% Hasten
	Select 250 mL/ha + 1% Hasten
	Fusion 280 g/ha + 0.75% Hasten
	Hoegrass 1.5 L/ha + 0.25% Wetter
	Achieve 200 g/ha + Hoegrass 300 mL/ha + 0.75% Supercharge
	Oust 200 g/ha + 1% Hasten
	Select 220 mL/ha + Targa 100 m/ha + 1% Hasten
Boom Details	Standard 02 nozzles, 2 bar pressure, 80 L/ha water

Results:

Herbicide	Average % Control	% Paddocks with >80% Control	% Paddocks with <40% Control	Number of Paddocks Tested
Targa	3	0	100	5
Hoegrass	2	0	100	13
Sertin	59	50	50	4
Select	86	78	0	18
Fusion	70	44	17	18
Aramo	80	67	17	12
Select/Targa	72	50	0	10
Achieve/Hoegrass	34	0	33	6
On-Duty	33	0	100	5
Oust	22	0	81	16

Note: Paddocks selected for testing tended to be problem paddocks with regards to ryegrass control. Levels of resistance reported here therefore are not a true reflection of the average resistance levels found in paddocks in this area.

Interpretations/Comments: The level of ryegrass resistance to Targa and Hoegrass (both Group A fops) was extreme. The level of resistance of Group A dims varied slightly with Sertin only controlling 59% of the ryegrass population on average. Select, Fusion and Aramo (a new 'dim' herbicide due for release in 2003) had slightly better results. Although paddocks have not been exposed to the new active ingredient in Aramo, there are still paddocks showing resistance. Aramo will have to be used in an integrated resistance management program to prolong its effective life.

Fop/dim mixes i.e. Select/Targa and Achieve/Hoegrass are not giving high levels of control as would be expected. The mixing of the fop and dim may be questioned as the most effective way to control ryegrass, perhaps a strong dose of 'dim' alone would be better at controlling ryegrass.
Oust is a non-selective group B chemical. The resistance levels for oust indicate that Group B chemicals would struggle to control ryegrass in these paddocks. On-Duty is also a Group B chemical but is used in IT wheat and canola systems. From these results, IT wheat and canola is not providing an alternative for controlling ryegrass.

Summary:
- The levels of resistance reported are from targeted problem ryegrass paddocks and are not a true indication of the areas overall resistance status.
- There is a high level of ryegrass resistance to 'fop' chemicals in these tests.
- 'Fop/dim' mixes are not giving better control of ryegrass than 'dim' chemicals at high rates.
- Select and Aramo ('dims') are not giving total control of ryegrass and must be used within a management program that rotates chemical use to prolong the life of these chemicals.
- Ryegrass tested is showing a high level of resistance to Group B chemicals.

Kill Half Leaf Ryegrass With Spray.Seed® at Night

Aim: To determine which knockdown herbicide is best for small grass

Research Officer: Peter Newman
Company: Department of Agriculture, Geraldton

Department of Agriculture
Government of Western Australia

Farmer: Ian and Clinton Hunt
Location: Coorow

Background: Half leaf ryegrass is very hard to kill with herbicides alone. Glyphosate is translocated to the tip of the grass where it is ineffective. Spray.Seed® burns off the top of the plant, which can then recover as it is living on its seed reserves. Trial work in 2000 and 2001 showed that Spray.Seed® and glyphosate are equally ineffective when applied to half to one leaf ryegrass with control ranging from 30% to 79%. It has been hypothesised that weed control with Spray.Seed® may be improved when applied in the absence of sunlight due to improved translocation of the chemical.

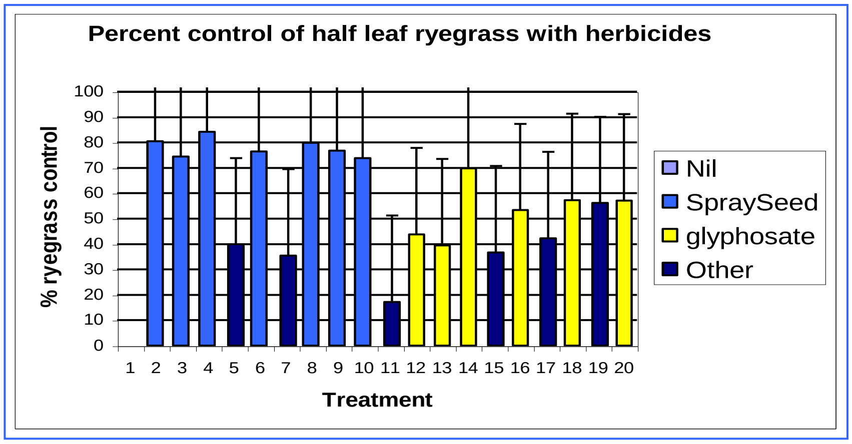
Trial Details:

Plots / reps	3 m wide x 30 m long plots, 2 reps
Soil type	Yellow sand over gravel
10th May 2002	Site was pegged and sprayed with Spray.Seed® 2 L/ha to kill a background population of 3 to 4 leaf ryegrass that had germinated on a previous rainfall
14th May 2002	Sprayed all treatments using the Department of Agriculture boom spray. The boom spray was set up to apply 50 L water /ha at 12 kph, through 02 (blue) nozzles. Ryegrass was at the half leaf stage, approximately 240 plants /m^2. Spray conditions were extremely overcast (ie. no sun visible), winds 5/8 km/h decreasing towards nightfall. Glyphosate treatments were applied from 2pm. Spray.Seed® treatments were applied from 5pm onwards.

Results:

Treatments – applied 14th May 2002	21st May rye/m^2
1. Nil	342
2. Spray.Seed 1 L/ha	66
3. Spray.Seed 1 L/ha + Logran Lightning 50 g/ha + Hasten 0.5%	87
4. Spray.Seed 1 L/ha + Diuron 150g/ha	54
5. Diuron 150 g/ha	205
6. Spray.Seed 1 L/ha + Trifluralin 480 @ 1.2 L/ha	80
7. Trifluralin 1.2 L/ha	220
8. Spray.Seed 1 L/ha + Hammer 30 mL/ha	69
9. Spray.Seed 1 L/ha + Pledge 30 g/ha + Hasten 1%	79
10. Spray.Seed 1 L/ha + Kerb 1 kg/ha	89
11. Kerb 1 kg/ha	283
12. Glyphosate 750 mL/ha	192
13. Glyphosate 750 mL/ha + Diuron 150 g/ha	207
14. Glyphosate 750 mL/ha + Pledge 30 g/ha + 1% Hasten	103
15. Pledge 30 g/ha + 1% Hasten	216
16. Glyphosate 750 mL/ha + Hammer 30 mL/ha	159
17. Hammer 30 mL/ha	197
18. Glyphosate 750 mL/ha + Logran Lightning 50 g/ha + Hasten 0.5%	146
19. Logran Lightning 50 g/ha + Hasten 0.5%	150
20. Touchdown B Power 1.63 L/ha (equiv of gly 490 @ 750 mL/ha) + 0.5% Hasten	146
LSD	118

Ryegrass counts include late germinating ryegrass that germinated between spraying the treatments and counting. The vast majority of ryegrass counted in the Spray.Seed® treatments appeared to be freshly germinated ryegrass as there were no visible burnt tip symptoms as seen in previous trials. Ryegrass counted in the glyphosate treatments were a mix of freshly germinated ryegrass and ryegrass that exhibited burnt tip symptoms (ie. had survived the glyphosate).



Conclusions: It appears that Spray.Seed® gave approximately 100% control of the half leaf ryegrass. While the data suggests that Spray.Seed® gave only 80% control of the ryegrass, anecdotal evidence suggests that the surviving plants were actually a new germination of ryegrass that was never sprayed with Spray.Seed®. Previous trial work has shown that half leaf ryegrass that survive applications of Spray.Seed® typically exhibit the symptom of a burnt leaf tip. This symptom was not apparent in the Spray.Seed® plots in this trial.

Ryegrass control with glyphosate was significantly lower than ryegrass control with Spray.Seed®. Ryegrass plants that survived glyphosate exhibited the burnt leaf tip symptom. When ryegrass is at the half leaf stage all translocation is from the roots and the seed upwards. It is not until approximately the 1.5 leaf stage that translocation occurs in both directions. Glyphosate applied to half leaf ryegrass is translocated to the tip of the leaf where it is ineffective.

The “Hair Cutting” technique involves spraying wheat at the half leaf stage with Spray.Seed® with the objective of killing weeds larger than one leaf. Bowran & Buckley (1991) demonstrated that wheat can recover from this treatment to yield 95% of the unsprayed control. The standard recommendation for this practice has been to spray wheat at the half leaf stage with Spray.Seed® in full sunlight where no Diuron has been applied pre-sowing or in a mix with Spray.Seed® to avoid killing the wheat crop. If we apply this to killing half leaf grass, the recommendation should be to spray small grass with Spray.Seed® + Diuron in overcast conditions or at night. Further laboratory and field research will test this hypothesis.

Some new group G herbicides are now on the market. Their main role is as a glyphosate spike to improve control of hard to kill broadleaf weeds such as Mallow and Wild Radish. They appear to have some activity on ryegrass, albeit a low level of activity. Glyphosate + Pledge (ie. new group G) was the best of the glyphosate treatments, although this result was not significant.

Kerb is primarily a root uptake herbicide. This trial is not a fair test of Kerb.

Dual Gold® safe in Lupins at Coorow

Aim: To assess the potential for the use of Dual Gold® for ryegrass control in lupins.

Research Officer: Peter Newman
Company: Dept. of Agriculture, Geraldton

Farmer: Mike Bothe
Location: Coorow

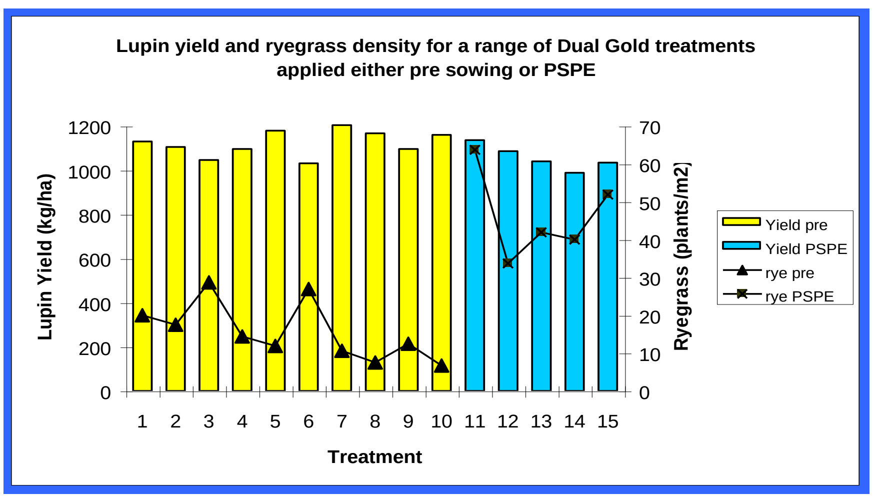
Background: Dual Gold® (s~Metolochlor) is a group K herbicide that has some activity on ryegrass, particularly when applied in a mixture with Diuron. As ryegrass develops resistance to a range of herbicide groups, novel mode of action herbicides (such as group K) are sought after by growers. Dual Gold® is currently registered for ryegrass suppression in Barley and Oats. Trifluralin currently forms the backbone of ryegrass control for many growers in a cropping rotation. There is a temptation to use Trifluralin in every phase of the rotation, which will no doubt result in wide spread Trifluralin resistant ryegrass. Dual Gold® may offer an alternative for ryegrass control in a cropping rotation if it is registered.

Trial Details: Trial area sown with knife points and presswheels by farmer as part of a bulk lupin crop. Ten herbicide treatments were applied pre sowing with knife points and presswheels, and five post sowing / pre emergent (PSPE) herbicide treatments applied to a level (ie. levelled using harrows PSPE) seed bed. In total 15 treatments with 3 replicates. Plots 37 m long X 3 m.

The front half of the trial received no basal Simazine.

The plots containing Trifluralin mixes were run over with finger harrows to incorporate the Trifluralin immediately after spraying.

Results:



Yield pre = lupin yield for treatments applied pre sowing, rye pre = ryegrass /m^2 for treatments applied pre sowing, PSPE = Post sowing pre emergent.

- Average number lupin plants = 47 / m^2 (+ harrows) and 44 / m^2 (- harrows)
- There was no significant difference in yield between any treatments

Treatment	Rye / m^2	Yield T/ha	1000 seed wt. (g)
Pre – sowing with knife points and presswheels			
1. Nil	20	1.13	156.1
2. Dual Gold 500 mL/ha	18	1.11	157.7
3. Diuron 500 mL/ha	29	1.05	155.6
4. Dual Gold 500 mL/ha + Diuron 500 mL/ha	15	1.10	157.4
5. Dual Gold 1 L/ha + Diuron 1 L/ha	12	1.18	161.0
6. Diuron 2 L/ha	27	1.03	157.4
7. Trifluralin 480 1.25 L/ha	11	1.27	158.5
8. Dual Gold 500 mL/ha + Trifluralin 1.25 L/ha + Avadex 500 mL/ha	8	1.17	156.4
9. Dual Gold 500 mL/ha + Trifluralin 1.25 L/ha	13	1.10	156.7
10. Dual Gold 500 mL/ha + Diuron 500 mL/ha + Trifluralin 1.25 L/ha	7	1.16	156.5
Post – sowing / pre emergent to level seed bed (harrowed)			
11. Nil	64	1.14	155.6
12. Dual Gold 500 mL/ha	34	1.09	155.0
13. Diuron 500 mL/ha	42	1.04	153.7
14. Dual Gold 500 mL/ha + Diuron 500 mL/ha	40	0.99	153.1
15. Dual Gold 1 L/ha + Diuron 1 L/ha	52	1.03	153.1
LSD	26.6	n.s.	1.41

Conclusions: There appeared to be no difference in yield between the plus and minus basal Simazine areas. All of the results presented and discussed received Simazine 2 L/ha pre sowing. Dual Gold® had no effect on lupin yield in this trial. The dry seasonal conditions may have contributed to this high level of crop safety. This trial is not a herbicide tolerance trial, however, it does suggest that Lupins do have some tolerance to Dual Gold® and future investigation is warranted.

Dual Gold® requires moist soil conditions for optimal ryegrass control. Dual Gold® plus Diuron at label rates controlled only 25 to 40% of the ryegrass. Dual Gold® is taken up by plants largely through the coleoptile as it emerges through the soil surface. Ideally the soil surface should be moist for two to three weeks after seeding of the crop for Dual Gold® to work at its best. 2002 was a dry season at Coorow, which is the most likely reason for the poor ryegrass control.

Treatments including Trifluralin gave the best ryegrass control in this trial. Trifluralin, when incorporated into moist soil forms a gas which impedes ryegrass germination. This gas appears to have the ability to persist when the soil dries, and continues to kill ryegrass.

The use of harrows to level out the seed bed for the PSPE treatments appears to have stimulated a germination of ryegrass. The control treatment for the harrowed area had 64 ryegrass / m^2 compared to 20 / m^2 for the control of the un-harrowed area. Applying Dual Gold® PSPE to a level seed bed is the recommended practice, however, if harrowing is necessary to level the seed bed, the increased ryegrass germination may outweigh the benefits of Dual Gold®. Regression analysis suggests a trend that high ryegrass density reduced yield.

If Dual Gold® was registered for ryegrass control in Lupins it may be possible to use it as an alternative to Trifluralin or in a mix with Trifluralin to reduce the development of Trifluralin resistance. Applying full rates of two alternative modes of action herbicides for ryegrass control is a good strategy to delay the onset of herbicide resistance.

Evaluation of 2 New Herbicides in the Field – Bounty & Aramo

Aim: To determine the effectiveness, weed spectrum and crop damage of both Bounty (a broadleaf herbicide for use in lupins) and Aramo (a grass herbicide for use in non-cereal crops), which are due for release on the market in 2003.

Research Officer: Brett Beard
Company: Elders Limited, Dalwallinu

Elders Limited
ACN 004 045 121

Farmer: Garry Helliwell
Location: Maya East Rd, Maya

Background: Metribuzin for controlling doublegees in less tolerant lupin varieties such as Wonga, Tanjil and Belara has lead to an unacceptable reduction in yield. Bounty is a product from Bayer Crop Science that is capable of controlling doublegees and wild radish in lupins safely. It is a mixture of 595 g/kg diflufenican and a new active of 270 g/kg 'ethametsulfuron methyl'.

With significantly more pressure being put on grass herbicides for ryegrass control and the ensuing resistance problems, new chemicals are becoming increasingly necessary. Aramo (200 g/L tepraloxydim) is a new 'dim' grass herbicide being released by BASF for controlling ryegrass (and other grasses) in non-cereal crops and is aimed to be a direct competitor with Select by Sumitomo.

Trial Details:
4 rates of Bounty and a Brodal/Metribuzin brew were sprayed on the 26th July 2002 on 4 -12 leaf Belara lupins. Wild radish, canola, doublegee and capeweed ranging from 2 - 8 leaf were also present.

63.75 g/ha Bounty + 0.1% WA
85 g/ha Bounty + 0.1% WA (Recommended Rate)
127.5 g/ha Bounty + 0.1% WA
170 g/ha Bounty + 0.1% WA
100 mL/ha Brodal + 100 g/ha Metribuzin

4 rates of Aramo and one of Select were sprayed on 26th July 2002 on 4 -12 leaf Belara lupins. Ryegrass and volunteer cereals ranging from 2 leaf – mid/late tillering were also present. Approximately 700 ryegrass plants/m^2.

150 mL/ha Aramo + 1% Hasten
225 mL/ha Aramo + 1% Hasten
300 mL/ha Aramo + 1% Hasten (Recommended Rate)
600 mL/ha Aramo + 1% Hasten
300 mL/ha Select + 1% Hasten

The trial was sprayed with a hand boom at walking pace and 40 psi pressure. This equated to 76 L/ha water rate.

Visual assessments and plant counts of crop and weeds were taken on 21st August, 2002.

Results & Comments:
Bounty seemed to do a good job on the doublegees. At the lower rates (85 g/ha and under) doublegees were sufficiently suppressed (even the larger ones). Above 85 g/ha and with the Brodal/Metribuzin brew the doublegees were controlled. At the recommended rate it did a good job of suppressing the larger radish and canola and controlled the smaller (under 4 leaf) ones. Bounty also did a reasonable job on suppressing the capeweed. Brodal/Metribuzin did as good a job on all weeds, but the effect was more pronounced with complete control rather than suppression.

Bounty seems to be a lot safer on the lupins at all rates (except for the larger lupins at the 170 g rate where they were a bit scorched) than the Brodal/Metribuzin, where there was quite a bit of leaf scorching.

All Aramo treatments did an excellent job especially considering the conditions at time of spraying. Half rate of Aramo did an 85% job while a full rate did 99%. Anything above a full rate gave near on 100% control. The Select plot also gave near on 100% control.

Select and Aramo seem to do an equal job on ryegrass populations at all growth stages up to mid tillering. Both products work exceptionally well and definitely look like the products of choice for controlling dim-susceptible ryegrass populations.

Both were safe on the lupin crop as can be expected. Both gave very good control of volunteer cereals as well.

These trials were not harvested due to the season therefore yield data is not available. The visual results indicate that both of these chemicals (Bounty and Aramo) perform as well and even better than expected under the conditions experienced.

Summary:
- Both Aramo and Bounty performed as expected in the field in accordance with the label recommendations.
- Conditions at time of spraying and for the rest of the season were not favourable, however both products stood up and performed quite well when compared to the unsprayed areas.
- I will have no problems in recommending both of these products in the field in the future.

Chickpea Variety Trial Coorow

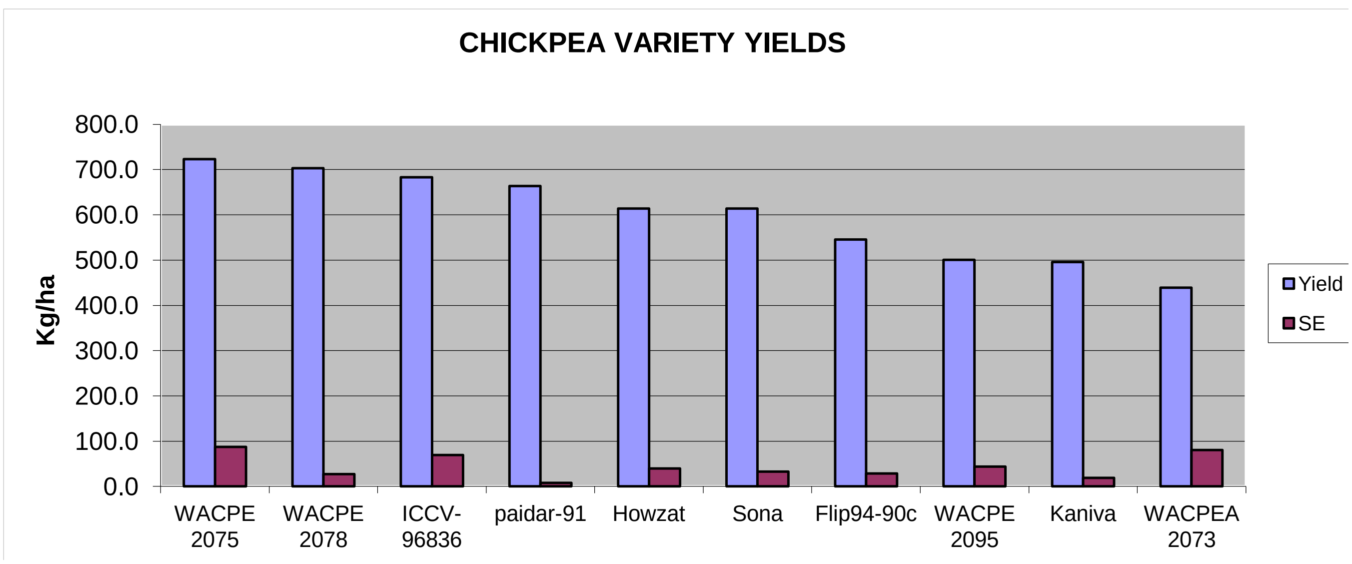
Research Officer: Martin Harries
Company: Department of Agriculture, Geralton

Farmer: David and Alistair Falconer
Location: Coorow

Background and Aim:
New lines of chickpea with better ascochyta resistance and or higher yields are required. While results were variable yields were quite high considering the low rainfall at the site.

Results:

VARIETY	Yield KG/HA	SE
WACPE 2075	722.7	87.6
WACPE 2078	703.0	27.2
ICCV-96836	683.3	69.5
paidar-91	663.5	8.0
Howzat	614.2	39.5
Sona	614.2	32.7
Flip94-90c	545.1	28.8
WACPE 2095	500.7	43.6
Kaniva	495.8	18.9
WACPEA 2073	439.1	80.1



- **Summary:**
- Many of the new lines that have better ascochyta resistance than Sona out-yielded Sona.
- Sona is susceptible to ascochyta while WACPE 2073 and Kaniva are highly susceptible.
- Resistance of other lines are rated as moderately resistant to moderately susceptible except for FLIP94-90C and ICCV that may be classed as moderately resistant depending on further results.

Kondinin Group and Liebe Group compaction trials

Research Officer: Peter Walsh,
Company: Kondinin Group

In Brief:

- This article is a brief description of the soil compaction tests carried out by Kondinin Group engineers at the Liebe Group Spring Field Day.
- Until now it has been difficult, even for experts, to detect soil compaction across paddocks at depths of more than 100–400mm without digging a series of soil pits.
- A new method is being developed to measure compaction within the soil profile.
- Tests at Buntine, Western Australia, showed four tractors and one grain harvester caused soil compaction sufficient to halt root growth, regardless of tyre or track pressures.
- Tracked tractors confined compaction to a narrower strip within the paddock than tractors with tyres.
- A full report on the testing including colour charts is available in the December edition of *Farming Ahead.*

New method yields a worm's-eye view. Any farmed soil can become compacted, reducing plant root growth and harvest returns. This article outlines a prototype method that could allow farmers to view the extent of compaction caused by sowing or harvest machinery. In time, this will allow farmers to see what is happening in their soils without having to dig a soil pit.

Soil compaction costs agriculture up to $850 million every year in lost production yet many farmers are unaware of its presence in their soils.

But help is at hand with a new method set to provide a clearer picture of how machinery causes compaction within the soil profile. The method uses a penetrometer to test for compaction (soil with a high penetration resistance called 'strength') and soil maps to show the impact of machinery on soil (see Figures 1 and 2).

Figure 1

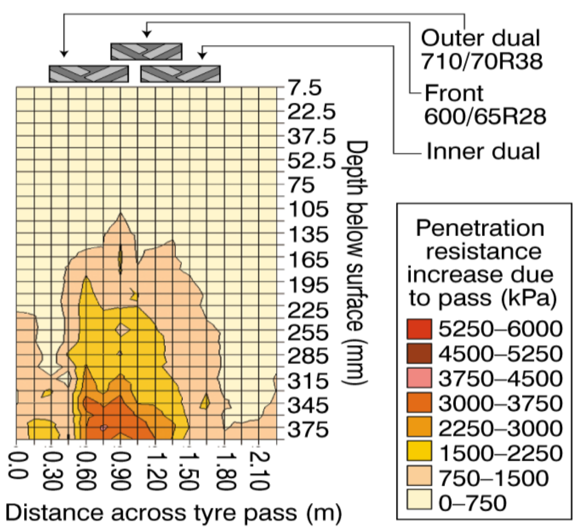
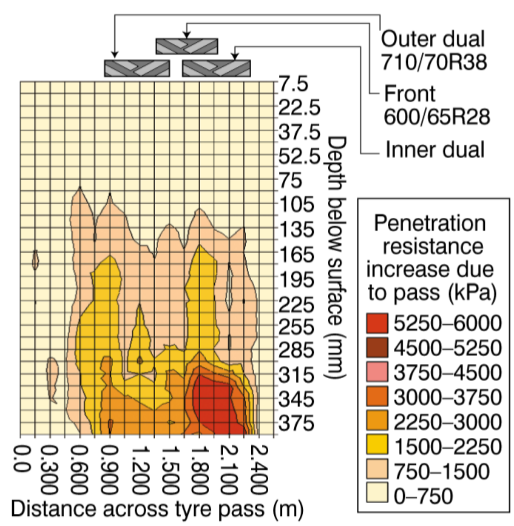


Figure 2



Although still under development by Kondinin Group, the method was put to the test recently at Buntine, Western Australia, with Liebe Group farmers and researchers from the Department of Agriculture, WA.

For this article, the researchers measured soil strength before and after six machines had passed over a defined test area. In addition to the penetration tests, soil pits were used to assess soil compaction visually. Soil moisture content was also measured.

Tested machinery:
Machines tested included the John Deere 8420 front wheel assist (FWA) tractor, a John Deere 8420 FWA tractor at 10 per cent wheel slip, a Case Quadtrac STX450 tractor, a John Deere 8420T, a Case four-wheel-drive STX450 articulated tractor and a Case 2366 grain harvester.

On Buntine's gravelly sand soil, all machines tested produced soil compaction sufficient to halt plant root penetration at depths of about 300mm. Applying these results to other locations is difficult as some clay-type soils become compacted at the surface. The Buntine soil is stable and contains no swelling clay, so the compaction caused during the tests could persist for many years. Farmers at Buntine were encouraged to use minimum-tillage, direct drilling or controlled traffic to minimise compaction effects on crop yields.

How to read compaction graphs:
Figures 1and 2 show how compaction changed through the profile when different machines passed over the soil. Each vertical line represents the penetrometer insertion point in the soil.
The horizontal lines show the depths at which compaction was measured. The colours show soil areas within the profile with similar compaction levels.

To produce the graphs, researchers took penetrometer readings 150 mm apart across the path of the tractor before the tyres passed over the site. A second row of readings was taken after the tractor or harvester had passed over the test area. The penetrations were displaced by 75 mm to avoid touching the 'before' holes. The readings for each point in the soil profile were subtracted to produce only the change in strength caused by the machinery.

Figure 1 shows a soil profile of one side of a John Deere 8420 FWA tractor with front single tyres followed by rear dual tyres. The tractor was on radial tyres with rear duals (710/70R38) set to 45 kilopascals (kPa) (or 6.5psi) with the front singles (600/65R28) set to 165kPa (24psi).
Tyre icons appear above each graph to show where the tyres passed over the soil. Front single wheels are located between the rear duals but offset slightly toward the inner dual. To interpret the graphs, imagine viewing a rectangular flat plate inserted into the soil at right angles to the direction of travel.

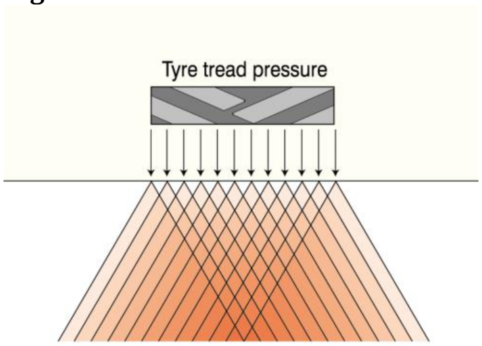
In the Figures, the plate is about 2 m wide and is pushed into the soil to a depth of about 400 mm. The mapping software used exaggerated the vertical scale compared with the horizontal scale.

Testing for compaction:
To test for compaction, Liebe Group farmers irrigated the soil to field capacity and deep ripped it to about 450 mm. The test conditions were similar to those at sowing after a deep rip operation.

Figures 1and 2 show lightly coloured areas near the soil surface. These areas experienced little change in soil strength after the machinery had passed over them. Many observers find this puzzling and would expect the worst compaction to be just below the soil surface. But in sandy soils, surface layers are dryer and less easily compacted.

How sandy soils become compacted:
Figure 3 shows the behaviour of sandy soils under tyres or tracks. Each arrow represents the pressure from a small width of tyre. The triangle represents the area of soil influenced by each arrow. It is immediately apparent that soil at some depth below the tyre pass is most affected.

Figure 3



The depth is governed by the tyre (or track) width and the angle at the top of the triangle, which is a property of the particular soil type. Figure 3 also helps show why livestock hooves and utility tyres do not cause compaction at depth. To resist the large force applied by a machine's weight, deeper soil tends to be compressed and sand grains become packed more tightly. This appears as increased resistance to the penetrometer indicating higher compaction levels. Figure 1 shows soil compaction is confined to the zone directly below the tyre.

Sharp edges are evident on both sides of the high compaction areas immediately below the outer tyre edges and the area of highest strength is below the tyre centre. Plant roots will not normally explore areas that have a penetration strength of more than 3000 kPa.

Because the graphs show changes in penetration resistance, the critical figure on the graphs is any area more than about 2000kPa (severe compaction). Figure 2 was produced with the same John Deere 8420 tractor with an implement attached to provide a draft force sufficient to cause 10% wheel slip as measured by the on-board monitor. The tractor was stopped after the tyres had passed over the test area but before the implement caused any damage. In general, the addition of wheel slip did not affect the pattern of compaction when compared with Figure 1.

The most notable differences are a larger area of severe compaction (more than 2000 kPa) and a highly compacted area under the front tyre and inner dual. Wheel slip is known to increase soil compaction by adding a horizontal force to the vertical force caused by a machine's weight. The additional force provides movement in the horizontal direction, which adds to compaction by allowing the soil grains to rotate and become packed more tightly. The compaction location is likely to be due to the combined effect of the front tyre with wheel slip followed by the inner dual.

Acknowledgements: Paul Blackwell; Department of Agriculture, WA; Stuart McAlpine, Liebe Group; Mark and Mel Shaw; Jolly and Sons for the supply of John Deere equipment and Cunningham's Ag Equipment for the supply of Case gear.

The Diamonds on Track for Tramline Farming

Aim: To establish an operational tramline farming system

Development and Research Officers: Bindi Webb, Paul Blackwell
Company: Department of Agriculture Western Australia and GRDC

Department of Agriculture Government of Western Australia

Grains Research & Development Corporation

Farmer: Neil and Kim Diamond
Location: Diamond Rd, Maya.

Background: Tramline Farming has the potential to reduce inputs by 10% and increase yields on sandy soils by up to 10% which translates to a benefit of $45/ha ($150/ha inputs and 2t/ha yield valued at $150/t on farm). These benefits are gained by confining soil compaction to permanent tramlines by controlling traffic.

This year Kim and Dianne together with Neil and Jo Diamond, have sown their 2002 cropping program to up and back Tramlines using dGPS autosteer (Beeline) system. Their observations of successful tramline farming systems on the Tramline Farming tour in 2001 inspired them to implement the system on their own property.

Tramline farming system details: The Diamonds have matched their machinery width to fit the header in the system and have two track widths for different machinery.

Area cropped 2002	1900 ha
Macinery ratio	3:1 boom/bar
Machinry widths	Seeder bar = 9 m, boom spray = 27 m, header = 9 m
Tramline track widths	2.2 m for seeding tractor and sprayer 3 m track for air seeder box and sprayer
Tramline type	bare
Direction of working	Up and back
Guidance system	dGPS auotsteer +/- 2 cm accuracy

In case autosteer was not available at seeding the Diamonds pre-marked paddocks. This was done two ways in combination with other paddock operations for greater efficiency:
1. While fertiliser was spread on autosteer waylines a pair of marker arms mounted on a 3 point linkage frame were used to mark runs.
2. While burning, autosteer waylines were used to rake stubble into windrows on 9 m spacings for guides during spraying and seeding.

Tramline farming and the use of a precise guidance system have provided many new opportunities to increase the efficiency of their farming system. The Diamonds have designed and built a 30ft shield sprayer with Holtfreters in Northam. The sprayer will be used for inter-row shield spraying between 18 inch lupin rows. Early spraying runs of the shield sprayer have gone well. The shield spraying of the lupins allowed Kim and Neil to delay the final decision about harvesting or spraying out the lupins till later in the season when the spring finish was more evident. With normal spraying the decision would have to have been made earlier to avoid grass seed set.

Relay planting maize into lupins is another possibility. Last year, the Diamonds used a precision summer crop planter to sow maize on 1 m spacings between rows of lupins when the lupins were filling pods about 10 weeks before harvest. At harvest the tallest maize was 300 mm high that was the same height as the lowest lupins pods. The maize was pushed under the cutter bar as the lupins were harvested. Relay planting gave at least a 10-week time of sowing advantage, compared to normal sowing after harvest. The maize was also sown into more moist conditions. Because the lupins were dropping their leaves when the maize was planted, more light was able to reach the emerging maize crop. As well as summer crops lucerne will also be planted into barley at 1 m spacings after post emergent spraying.

Diamond 30ft shielded sprayer

Neil Diamond believes "the input cost savings achievable with controlled traffic were too great to ignore. The system has allowed us better opportunities for relay planting summer crops and perennials (lucerne) and the use of shield spraying in lupins. Once the driver has learnt how to use the navigator, driving has become easier and less fatiguing".

Summary:

- An integrated Tramline Farming system is possible in real life.
- A good match is a 3:1 machinery width ratio including the header.
- Autosteer dGPS guidance opens up other opportunities such as relay planting and shielded spraying.

Herbicide Tolerance of Melaleucas and Oil Mallees on a Sandplain Seepage at Bunjil.

Aim: To examine the tolerance of Melaleucas and oil mallees to a range of herbicide treatments.

Research Officer: Mike Clarke, Revegetation Officer, and Dave Nicholson, Technical Officer,
Company: Department of Agriculture, Geraldton.

Farmer: Brian King
Location: Rabbit Proof Fence Road, Bunjil

Background: CALM is currently screening a number of species of *Melaleucas* that have been identified as having commercial potential for leaf oil and biomass production. Unlike oil mallees, *Melaleucas* have the added advantage of being tolerant to saline conditions and could offer farmers another commercial option for salt affected soils.

Very little information is available on the tolerance of these plants to the herbicides commonly used in farming operations. This information is necessary not only from the point of view of spray drift onto trees from adjacent crops and pastures, but more importantly for weed control within the tree plantings. It is hoped that the results of this trial will shed some light on the effect that some chemicals may have on trees. **Please note that the herbicides used in this trial have no registration for use on these species.**

Trial Details:

Plot size and replication	6 m x 30 m – 3 replicates X 2 blocks top block (drier, less salt affected block) bottom block (wetter, closest to seepage)
Soil type	Sandplain seepage
Planting date	16/07/02 planted as seedlings
Spraying dates	Pre planting 16/07/02 and post planting 10/09/02
Species used	1. *Eucalyptus polybractea* 2. *E.loxophelba var. lissophloeia* 3. *E.plenissima* 4. *E.horistes* 5. *Melaleuca lateriflora variety 1* 6. *M. lateriflora variety 2* 7. *M. lateriflora variety 3* 8. *M.uncinata "spicate"* 9. *M. uncinata "stubby"* 10. *M.stereophloia*
Herbicide treatments (all surface applied)	1. Control 2. Roundup Max® @ 0.882 L/ha (equivalent to 1 L/ha Glyphosate 450 gai) **(post planting).** **3.** Stomp® 330 gai @ 6 L/ha **(post planting).** 4. Eclipse® @ 10 g/ha +Verdict 520® @ 100 mL/ha + Select® @ 250 mL/ha + Uptake® @ 0.5% **(post planting).** 5. Logran® @ 15 g/ha + Verdict 520® @ 100 mL/ha + Select® @ 250 mL/ha + Uptake® @ 0.5% **(post planting).** 6. Brodal® @ 300 mL/ha+ Simazine @ 6 L/ha **(pre planting).** 7. Brodal® @ 500 mL/ha **(pre planting)**
Spray application rate	84 L/ha
Assessment dates	10/09/02 and 18/10/02

Results:

Table 1. Weed suppression ratings, expressed as percentage controlled, 5 weeks after spraying post planting treatments and 13 weeks after pre planting treatments

Weed type	Glyphosate	Stomp	Eclipse+ Verdict+ Select	Logran + Verdict + Select	Brodal + Simazine	Brodal
ryegrass	53	27	85	93	97	0
capeweed	82	20	37	40	100	100
ice plant	97	43	50	77	100	100
salt spurry	88	63	30	67	100	100

Table 2. The survival rates (%) of seedlings at 5 weeks after spraying post planting treatments and 13 weeks after pre planting treatments. **Drier Top Block**.

Species	Control	Glyphosate	Stomp	Eclipse + Verdict + Select	Logran + Verdict + Select	Brodal + Simazine	Brodal
1. Eucalyptus polybractea	92	100	89	92	100	28	89
2. E.loxophelba var. lissophloeia	67	42	100	100	83	33	100
3. E.plenissima	72	85	93	100	92	0	72
4. E.horistes	83	71	76	88	100	8	50
5. Melaleuca lateriflora var 1	67	100	93	100	93	87	89
6. M. lateriflora var 2	92	93	83	100	93	87	100
7. M. lateriflora var 3	77	100	89	100	100	67	100
8. M.uncinata "spicate"	67	92	57	78	100	31	67
9. M. uncinata "stubby"	100	100	78	93	92	70	89
10. M.stereophloia	100	100	71	100	93	73	67

Table 3. The survival rates (%) of seedlings at 5 weeks after spraying post planting treatments and 13 weeks after pre planting treatments. **Wetter block closest to saline seepage**.

Species	Control	Glyphosate	Stomp	Eclipse+ Verdict + Select	Logran + Verdict + Select	Brodal + Simazine	Brodal
11. Eucalyptus polybractea	71	33	33	83	67	7	89
12. E.loxophelba var. lissophloeia	89	13	67	53	73	28	56
13. E.plenissima	50	47	44	66	28	67	67
14. E.horistes	83	67	98	67	77	0	33
15. Melaleuca lateriflora var 1	100	93	93	100	100	80	100
16. M. lateriflora var 2	80	93	85	100	78	93	100
17. M. lateriflora var 3	93	87	100	100	87	53	100
18. M.uncinata "spicate"	100	92	100	93	92	7	83
19. M. uncinata "stubby"	56	78	54	100	57	33	60
20. M.stereophloia	100	100	100	100	93	92	89

Interpretations/Comments:
On tree survival:
As expected on a saline site the *Melaleuca's* had the greatest survival compared to the *Eucalypt's*. Overall survival of *Eucalypt's* on the more saline block was 55% compared with 75% survival on the drier block. This compares with overall survival for the *Melaleuca's* of 85% on the more saline block and 86% on the drier block. Because of the complications associated with the *Eucalypt's* struggling to survive from the saline conditions alone, the results from the *Melaleuca's* are more reliable to examine.

The *Melaleuca's* were more tolerant of all the herbicide treatments when compared to the eucalypts. (see the table 4).

Table 4. Survival of all species across the 7 treatments and both blocks.

Treatment	Average survival across all *Melaleuca* species	Average survival across all *Eucalypt* species
Control	86	76
Glyphosate	95	57
Stomp®	84	75
Eclipse® + Verdict® + Select®	97	81
Logran® + Verdict® + Select®	90	77
Brodal® + simazine	64	21
Brodal®	87	69

On weed control:
The brodal/ simazine mix controlled both broadleaf weeds and grasses in the trial and will have a residual effect in controlling summer weeds and in possibly controlling weeds the following growing season, depending on rainfall.

The glyphosate, Brodal® and Brodal®/simazine mix treatments were very effective on ice plant and salt spurry, which are 2 weed species that are common around sandplain seeps. The efficacy of the herbicides may have been affected by the dry conditions in 2002; therefore further work is needed to verify the results in an "average" year.

Summary:
As expected Melaleuca's had a greater survival on the site across all treatments when compared to the Eucalypts, as they are better adapted to saline conditions. The Brodal® / simazine mix was the most damaging across all species but provided the best weed suppression. The Eclipse® /grass selective mix was the least damaging across all species however, the Melaleuca's as a group, were more tolerant of all the herbicide treatments when compared with the Eucalypts.

Caution! This trial was designed to test the tolerance of various tree species to herbicides used in agriculture. As the herbicides have no registration for use in these trees, this trial cannot endorse these products for that use.

Acknowledgements:
We would like to thank the Brian King family for their support in providing the site and deep ripping the tree lines and Dan Huxtable for assistance in planting.

Rapid Catchment Appraisal 2002
The Moore River Catchment

Research Officer: Mike Clarke and David Rogers
Company: Department of Agriculture, Geraldton District Office

Background: In the Northern Agricultural Region, during 2002 a Rapid Catchment carried out in the Moore River Catchment. The headwaters are located in the Shires of Carnamah and Dalwallinu and the catchment drains southward through Moora to Mo joined by an eastern branch that drains the Shire of Victoria Plains. From here the Moore River drains westward and southward where it is joined by the Gingin Brook and finally reaches the Indian Ocean at Guilderton.

Please note: A comprehensive report (including a description of the method used) is provided under the "Local R&D Results 2002" section of the Liebe website.

Results: Note that Land Monitor products west of the Darling Fault are incomplete. The algorithm used for data analysis proved unreliable in landscapes where terrain is characterised by internal drainage . This has considerable impact on the statistics generated for Shires with significant areas west of the Darling Fault. These include the Shires of Coorow, Moora, Dandaragan and Gingin. Hence the following statistics relate only to the areas east of the Darling Fault, known geologically as the Yilgarn Craton.

The total area of the Moore River Catchment is approximately 1,380,000 hectares and on the Yilgarn Craton there are currently about 104,000 hectares of valley floors affected by salinity. Analysis of Digital Elevation Models suggest that up to 219,000 hectares are at risk of developing a shallow watertable.

Table 1. Land Monitor statistics for the areas of the Moore River catchment that occur east of the Darling Fault (known geologically as the Yilgarn Craton).

	Total catchment area		**Roads**		**Remnant vegetation**	
	hectares	percentage	Kilometres	percentage	hectares	percentage
Area currently affected by salinity in the valleys	104,000	7.5%	533	7.5%	25,839	7.7%
Areas at risk of developing a shallow watertable	219,000	16%	1,489	16%	34,440	10%

Costs of salinity.
With these figures in mind calculations show that the current cost of salinity to farmers in the catchment is around $4M each year. The increase in saline areas could be costing the catchment over $9M in lost production annually thirty years from now. Accounting for the loss of income of the thirty years results in a net present value of over $66M to the catchment in today's dollars. This however only looks at the on farm costs. The cost to the communities and towns will inflate this figure many times.

Remnant vegetation.
As with most catchments in the south west land division the Moore River catchment has been extensively cleared for agriculture. The vast majority of this clearing has occurred on the Yilgarn Craton where agriculture has had a longer history than the Perth Basin and where soil types are more fertile. For example, Perenjori and Dalwallinu shires have 8% and 9% remnant vegetation while Dandaragan and Gingin both have 52% remaining. Of the nearly 1.4 million hectares of the Moore River Catchment around 76% has been cleared.

The most extensive pre-European vegetation community found in the Moore River Catchment was a medium woodland of York gum and Salmon gum. This plant community, which previously occupied an area of around 214,000 ha has now been reduced to 14,000 ha or 6.6% of its former range.

Table 2. Dominant vegetation types and their pre-European and current extent.

Vegetation type	Pre-European extent (ha)	Current area (ha)	% of pre – European remaining
Medium woodland York gum and salmon gum.	214,280	14,156	7
Shrublands, scrub heath on yellow sandplain, Banksia-xylomelum	169,540	43,187	25
Medium woodland York gum and wandoo	142,026	18,686	13
Shrublands, Acacia neurophylla, A. beauverdiana & A. resinomarginea thicket	70,471	7,288	10
Shrublands, Allocasuarina campestris with patches of heath	65,570	4,153	6
Medium woodland York gum	64,632	6,545	10
Low woodland Banksia prionotes	54,218	24,799	46
Low woodland Banksia attenuata and B. menziesii	37,385	12,058	32

These figures illustrate the preference for clearing the more fertile soils associated with eucalypt woodlands compared with the pale deep sands associated with banksia low woodlands and other sandplain vegetation types. As these eucalypt woodlands occur predominantly on the valley floors it is these ecosystems that are most at risk of salinity as well.

Of the native vegetation remaining in the catchment much of it correlates with areas of salinity in the valleys and if watertables continue to rise then more is at risk of having a shallow watertable in the future. Table 3 shows the areas of remnant vegetation at risk in the Liebe area.

Table 3. Areas of remnant vegetation already affected by valley floor salinity and future areas at risk of a shallow watertable. (Note these Land Monitor statistics only represent the areas of the Moore River catchment east of the Darling Fault.)

Shire	Area of vegetation remaining (ha)	Area of vegetation affected by salinity in the valleys (ha) (includes halophytes)	Area of vegetation at risk of a shallow watertable (ha)
Carnamah	8,079	1,134	1,305
Coorow	69,147	14,560	13,929
Dalwallinu	13,245	2,801	5,145
Perenjori	10,245	2,626	3,753
Wongan Ballidu	29	0	1
Moore River total	**333,740**	**25,839**	**34,440**

As well as rising watertables the remnant vegetation is also under threat from passive clearing from grazing animals, damage from herbicide and fertiliser drift, weed invasion and altered fire regimes.

Management options.

Despite many of the groundwater monitoring bores displaying a decrease in the dry years since 1999, it is expected that **watertables will continue to rise in the medium term**. Research suggests that as much as 70 to 80% of a catchment may need to be planted to perennial vegetation to have a significant impact on intermediate groundwater systems (valley floor salinity). With current options limited, it is unlikely that farming systems will incorporate enough perennial vegetation to have significant impacts on groundwater recharge. Therefore it would be prudent to expect that **in future years more land in the Moore River Catchment will have a shallow watertable**.

There are six recognised options for managing dryland salinity. These are discussed further in the Moore River Catchment Report. They include:

1. Increase water use of annual crops and pastures
2. Increase water use by introducing perennial species
3. Improve protection and management of native remnant vegetation
4. Collect and re-use or dispose of surface water
5. Drain and pump and re-use or dispose of groundwater
6. Productive use and rehabilitation of saline land

The highlight of our investigations was that many of these options are already being implemented by individual farmers to tackle shallow watertables. The main recurring message in regard to developing shallow watertables, is not to delay in changing management. By acting early and changing management, farmers have far more agronomic options than waiting and allowing salts to accumulate in the topsoil through evaporation from shallow watertables.

Analysis of management options

An analysis (economic and water balance) was carried out to assess the economic potential of alternative farming systems for recharge control compared to the current farming system. (Please refer to Liebe website to determine method used).

The economical analysis was carried out looking at:

1. A current, or **do nothing scenario**, (standard practice annual rotations)
2. An **Extensive High Water Use scenario** (EHWU), phase cropping with lucerne (5yrs crop, 3yrs lucerne) on cropping areas and appropriate permanent perennial on non cropping country) and
3. A **Strategic High Water Use scenario** (SHWU), strategic use of perennials (appropriate perennials on non cropping country, eg. saltbush on saline areas, Tagasaste on deep gutless sands,etc).

The analyses show that current options for recharge control such as the phase cropping with lucerne, the EHWU option, are less profitable than today's cropping options. The good news is that the strategic use of perennials, SHWU option, is not only competitive economically with current farming systems, it results in only a 3% extra difference in the extent of salinity when compared with the EHWU farming system in the Moore River South Zone. In the Moore River North Zone the difference is an extra 6% more salinity extent after 50 years.

With the current options available, farmers should run their farm as productively as possible with a strategic focus on the sustainability issues most likely to affect that production. In some cases this may be issues such as soil acidification or waterlogging.

Managing salinity should be undertaken by targeting areas with shallow water tables for treatment as they arise with strategic perennials, thus stabilising these areas. In the future, perennial plants for broad acre application may be developed providing more productive perennial options for both cropping and non-cropping areas.

Key recommendations for individual landholders

As stated previously, groundwater levels are likely to continue to rise in the short to medium term. This means that more ground within the Moore River Catchment is likely to experience a shallow watertable in the future. The following list describes the priority actions that should be adopted to minimise the impacts of shallow watertables caused by **intermediate groundwater systems (valley floor salinity)**.

1. **Watch for early warning signs**. Landholders will have more management options available to them if they act early rather than wait and allow salts to accumulate in the soil surface. Not all farmers will have a network of bores on their property to alert them to watertables approaching the critical 2 metres from the surface level. Therefore it is important that early warning signs of shallow watertables are acted upon. These include **crops and pastures staying greener for longer** than

normal in landscape positions prone to shallow watertables. Also, indicator species such as **barley grass will start to appear** in paddocks. Areas with the potential risk of shallow water tables are good areas to site monitoring bores. Monitoring bores provide valuable information enabling a timely decision on when to change management on an area.

2. **Control stock on these areas**. At the very least farmers are encouraged to keep stock off these areas. Salt scalds **will** develop when sheep are allowed continual access. If livestock access is appropriately managed many sites will regenerate naturally to stands of bluebush or saltbush creating a more stable and productive area.

3. **Surface water control.** Ensure that surface water isn't impacting on these sites by adding to waterlogging problems. This may require grade banks above the site or W - drains on the site to deal with excess surface water.

4 **Change the agronomy**. There is a wide range of options available to landholders for areas of the farm that are not in rotation with annual crops. On these areas perennials provide an economically competitive alternative to annuals. They also provide, in many cases, a valuable out of season fodder source. For areas that are in a cropping rotation the alternatives are much more limited. In rotations that include annual pastures there is the potential to marginally increase water use by using appropriate deeper rooted and longer seasoned pasture varieties where they are suited (eg serradellas on deep sands, biserrula on deeper loams). Other options include agroforesty such as Maritime Pine or Oil Mallees.

   A perennial that is currently available that has a role in phase farming across large areas is lucerne. However from our analysis it is not economically competitive with the current cropping system across the majority of the landscape. Lucerne can be a viable alternative when used strategically, on a small part of the farm, in well suited areas where it is intensively managed to provide specific outcomes (eg finish lambs). Many farmers in the Moore River catchment have had success with agronomic options such as sorghum, lucerne, alley farming with trees and barley, tall wheat grass, puccinellia, balansa clover and many others.

Localised groundwater systems (such as hillside seepages) have been successfully managed with strategic blocks of trees, strategic perennial fodder options and pumping for a water resource.

Where to from here?
The Department of Agriculture aims to support landholders and the wider rural community in their search for information about how to manage salinity on their farm or within their town.

If you require any information or support in relation to follow up after the Rapid Catchment Appraisal, please contact **Mike Clarke** at the **Department of Agriculture, Geraldton (99 568 527)**

Tools to Better Deal With Climate Risk

Research Officer: Peter Carberry, Neal Dalgliesh and Dean Hargreaves
Company: CSIRO/ APSRU, Toowoomba.

Queensland-based CSIRO researchers have developed links with the Liebe Group to explore ways to better handle the vagaries of climate. Funding for the two year project is provided through AAA-FarmBis Australia. Project use of the internet, as a core communication tool, is enabling farmers and researchers, from opposite sides of the continent, to explore issues of interest, through on-line, real-time Net Meeting sessions, which combine the skills of the researchers in soil monitoring, systems simulation and seasonal climate forecasting, with the farmers' expert knowledge of their own systems and environment.

A number of on-line meetings have been held to share information about local soils and seasonal yield potential with members of the Liebe Group. Three field visits were made during the season to meet local farmers and gain a better understanding of the issues.

Exploring the soil

Six on-farm sites have been established at Buntine, Wubin, Maya, Dalwallinu and Goodlands to measure properties both essential to successful crop simulation and to improve farmer understanding of their soil resources. Measurements included characterisation of the soils for water holding capacity and the monitoring of water and nutrient resources prior to and after the 2002 cropping season.

Water holding capacity of district soils

What do we mean by water holding capacity? Plant available water capacity can be shortened to PAWC and it indicates the ability of a soil to hold water that is available for subsequent crop production and may vary between soil types and across crops grown on any particular soil. Soils representative of the district, including sands (both deep sand and sand over gravel), a duplex soil and red sandy clay loams, were characterised for water holding capacity. PAWC (to a depth of 180cm) ranged from 87mm in the deep sands at Buntine to 104mm in the red sandy clay loam at Goodlands (Figures 1 and 2). The sand over gravel indicated a PAWC of 87mm to 90cm depth, although it is thought likely that roots penetrate deeper into the gravel and are able to access additional water (Figure 3). Data are not yet available for the duplex soil sampled at Wubin.

On face value, the fact that the deep sands are unable to hold as much water per depth layer (i.e. 0-15 cm layer, 15-30cm layer etc.) as the heavier soils would appear to be disadvantageous in terms of crop production. However crops grown on the deep sands are able to compensate by foraging deeper to access the resources they need. Whilst wheat grown on the heavier soils is unlikely to access water and nutrient resources deeper than 150cm (and in many cases less than this), crops grown on the deep sand were found to be extracting resources to a depth of 270cm during the 2002 season. When this extra depth of extraction is taken into consideration, the plant available water capacity increases from 88mm (to 180cm depth) to 109mm (to 300cm depth) although it has to be remembered that this additional water at depth is not as efficiently accessed as the shallower resource due to lower root densities.

Fig. 1

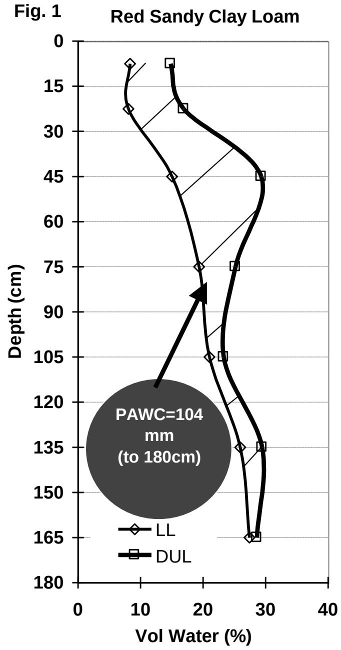


Fig. 2

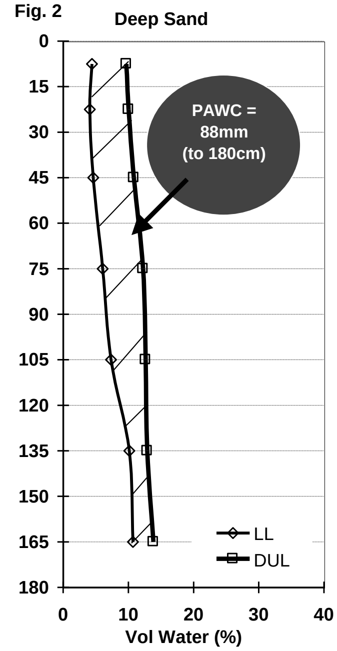
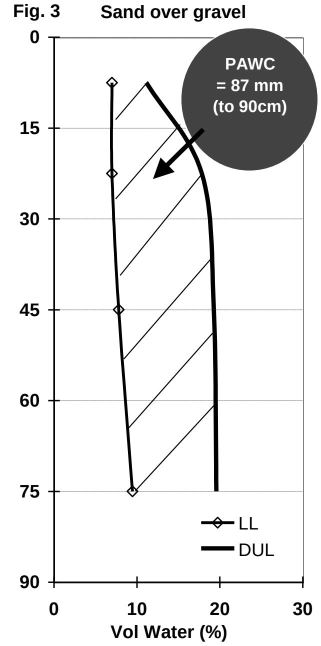


Fig. 3



Monitoring soil resources

Whilst PAWC indicates the capacity of the soil to store plant available water, knowing how full the bucket is at the start of the cropping season provides a practical tool for crop management and is essential for successful simulation. Figures 4, 5 and 6 show the amount of water stored in the Liebe soils during the summer fallow and leading up to seeding of the 2002 crop. The sandy clay loam (Figure 4) provides a good example of the impact of summer rainfall on available stored water compared to the other two sites that did not receive the same rainfall events.

Fig. 4

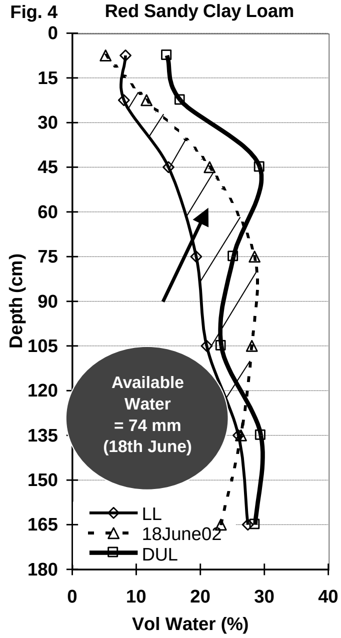


Fig. 5

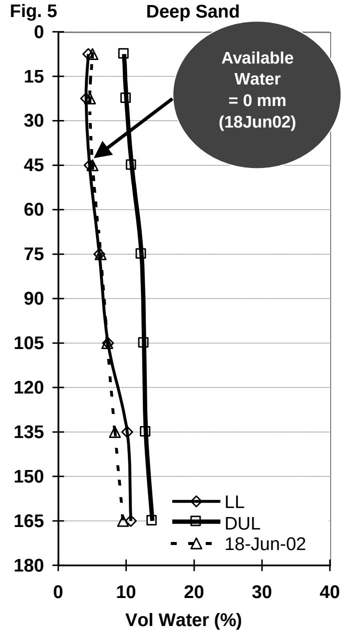
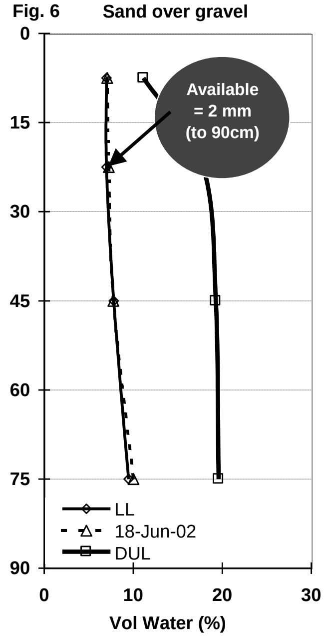


Fig. 6



Knowing the amount of stored water at the start of the cropping season may impact on decisions made by the farmer in terms of crop type or fertilizer regime. Simulation models enable the farmer to explore the impact and risk of possible management decisions prior to the season, and when linked with soil resource information and seasonal climate forecasting, can be a powerful aid to decision making.

Simulation of yield probabilities

Prior to and during the 2002 winter season, collaborating members of the Liebe Group were supplied with probabilities of simulated wheat yield expectations based on local soil and climate data and forecasts of seasonal rainfall outlook using the Southern Oscillation Index (SOI) signal. For example, Figure 7 shows the probabilities of exceeding certain wheat yields for wheat crops grown on a sand over gravel soil (Figure 3) - ie. Assuming wheat is simulated for 100 years of Dalwallinu rainfall. The long-term median simulated yield is about 1.8 t/ha. Figure 7 also shows the probabilities for attaining certain yields in 2002 given the seasonal conditions up until 10 August 2002 – ie. With the starting soil water measured in Figure 6 and the rainfall recorded to that point in time. Under the poor starting conditions in the 2002 season, the simulations suggested only a 15% chance of harvesting any yield.

Figure 8 shows the benchmark simulation for the wheat crop grown in 2002 on sand over gravel soil. Low and infrequent rainfall events resulted in simulation of little soil water accumulation and shallow rooting depths (top graph). The poor water environment resulted in simulation of poor leaf area development and growth. Simulated yield was 0.1 t/ha compared to 0.2 t/ha harvested from this paddock. The simulated benchmark confirmed that little could have been done to improve the yield prospects for wheat in this paddock in the 2002 season.

Fig 7: Yield probabilities

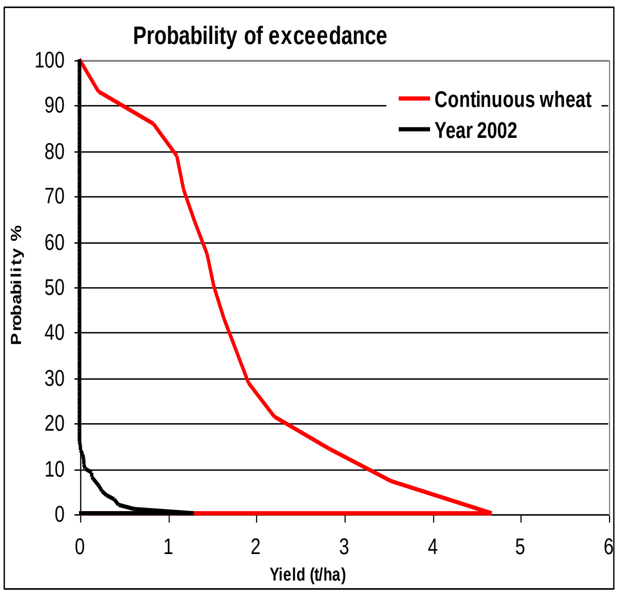
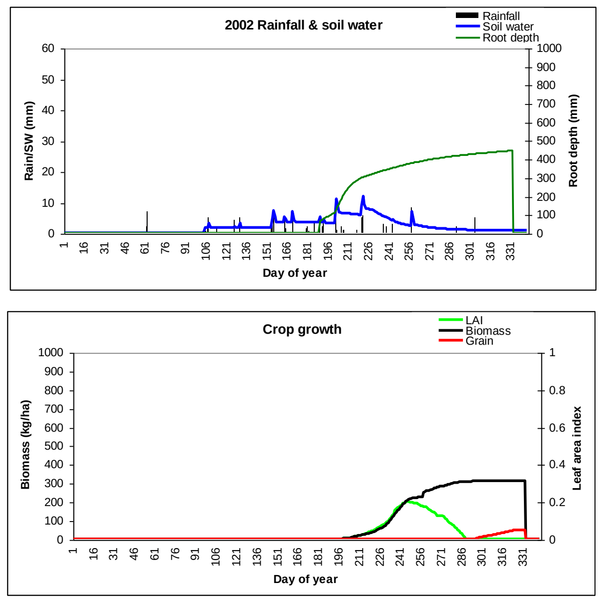


Fig 8: Simulated wheat growth in 2002.



Using information on soil water, seasonal climate forecasts and simulation modelling, APSRU is exploring whether farmers in the Liebe Group can better manage the impacts of climate variability on crop production.

BankWest Benchmarks from the Dalwallinu and Carnamah Area in 2001/02

The BankWest Benchmarks are a survey of the financial and production performance of WA farm businesses.

BankWest Benchmarks allow farm businesses to quantify their performance in comparison to other farmers in their district and region. Farmers can identify the strengths and weaknesses of their operations and look at the factors that help lift the top performing farms above the others.

Definition of terms

Capital Expenditure ($/Eff Hectare) – Expenditure on any capital items including land purchases with respect to the area farmed.

Crop Insurance ($/Eff Hectare) – Cost of crop insurance with respect to the area farmed.

Crop Insurance ($/Crop Hectare) – Cost of crop insurance with respect to the area cropped.

Effective Area (Hectare) – Land area used directly for the purposes of producing crops or livestock. Does not include non-arable land such as salt lakes, rocks and bush.

Farm Income – All income produced from farm related activities. Includes proceeds from the sales of all produce, CBH and diesel fuel rebates and receipts from contracting farm equipment.

General Insurance ($/Eff Hectare) – Insurance costs on buildings and vehicles etc. excluding crop insurance costs with respect to the area farmed.

Long Term Debt ($/Eff Hectare) – Equals liabilities less seasonal or short term liabilities such as funds drawn on an overdraft account and hire purchase expense, with respect to the area farmed.

Operating Costs – Relates to any payments made by the farm business for materials and services excluding capital, finance and personal expenditures.

Overhead Cost Subtotal ($/Eff Hectare) – Total of all indirect costs incurred by the farm business.

Paid Labour ($/Eff Hectare) – Payments made to any person for working on the farm business with the exception of the partners, family labour and work undertaken by contractors with respect to the area farmed.

Rainfall (mm) – Growing season rainfall (May-Oct). Bureau of Meteorology averages for each district.

Repairs Buildings, Fence & Water ($/Eff Hectare) – Cost of repairs and maintenance on buildings, fences and water supplies with respect to the area farmed.

Tax Liability ($/Eff Hectare) – Measures the provisional tax payable with respect to the area farmed.

Term Debt Repayment ($/Eff Hectare) – Principal repayments on long term debt with respect to the area farmed.

Total Income – Includes all farm income plus interest received, funds from sale of capital items, any loan funds advanced and any income derived from off-farm investments or other activity.

Total Personal (Inc. Super) ($/Eff Hectare) – All personal expenses incurred by the principals of the farm business including contributions to superannuation with respect to the area farmed.

Total Cash Outgoings – All expenses incurred by the farm business including all operating costs as well as capital, finance and personal expenditures.

Total Sheep Income ($/WGHa) – Income derived from sheep and wool sales with respect to winter grazed area.

Winter Grazed Hectares – Total effective area less the area cropped.

Wool Cut (Kg/WGHa) – Amount of wool cut with respect to winter grazed area.

Equity (%) – The % of owned assets. Calculated as total assets less total liabilities divided by total assets.

Low 25% - The average of the low 25% of farms in the group surveyed ranked by operating profit.

Other 75% - The average of the farms surveyed in each group, excluding the top 25% of farms ranked by operating profit.

Top 25% - The average of the top 25% of farms in the group surveyed ranked by operating profit.

DALWALLINU – COMPARATIVE ANALYSIS OF DISTRICT PERFORMANCE

	Average	Top 25%	Other 75%	Low 25%
Capital Analysis				
Effective Area (Ha)	3726	3572	3781	3240
Assets ($/Eff Ha)	1021	1161	972	828
Debt ($/Eff Ha)	97	101	96	110
Long Term Debt ($/Eff Ha)	54	61	51	49
Equity (%)	90%	91%	89%	86%
Long Term Debt to Income (%)	21%	17%	23%	32%
Return to Capital	4%	14%	1%	-4%
Machinery Value ($/Eff Ha)	190	219	180	170
Rainfall (mm)	199	220	192	195
Operating Analysis				
Farm Income ($/Eff Ha)	211	312	176	129
Operating Costs ($/Eff Ha)	129	138	125	112
Operating Return ($/Eff Ha)	83	174	50	17
Operating Profit ($/Eff Ha)	63	152	32	0
Operating Cost/Farm Income (%)	66%	45%	73%	86%
Grain % of Farm Income	86%	89%	84%	82%
Sheep & Wool % of Farm Income	10%	8%	11%	13%
Costs				
Operating Costs				
Seed & Treatments ($/Eff Ha)	3	3	2	2
Crop Insurance ($/Eff Ha)	1	1	1	1
Pesticides/Herbicides ($/Eff Ha)	26	29	25	22
Fertiliser ($/Eff Ha)	35	36	34	30
Contract ($/Eff Ha)	2	4	1	2
Fuel & Oil ($/Eff Ha)	14	13	14	14

Repairs & Maintenance ($/Eff Ha)	14	16	14	13
Conservation ($/Eff Ha)	1	0	1	1
Repairs BFW ($/Eff Ha)	1	2	1	0
Paid Labour ($/Eff Ha)	6	6	6	3
Overhead Costs				
Rates ($/Eff Ha)	4	5	4	3
Licences ($/Eff Ha)	1	2	1	1
General Insurances ($/Eff Ha)	3	4	3	3
Professional Fees ($/Eff Ha)	3	3	3	2
Telephone & Electricity ($/Eff Ha)	2	2	2	2
Overhead Costs Sub Total ($/Eff Ha)	16	18	15	14
Other Costs				
Total Personal Expenditure ($/Eff Ha)	18	21	17	15
Taxation ($/Eff Ha)	1	3	1	0
Loan Repayments ($/Eff Ha)	11	25	7	12
Hire Purchase & Lease ($/Eff Ha)	12	14	12	10
Capital Expenditure ($/Eff Ha)	32	40	29	16
Interest on Loans ($/Eff Ha)	10	7	11	13
Cropping Analysis				
Total Crop Area (Ha)	2632	2597	2644	2086
Crop % of Effective Area (%)	71%	73%	70%	65%
Machinery Value ($/Crop Ha)	273	303	262	277
Crop Yields				
Wheat (t/Ha)	1.7	2.1	1.6	1.4
Barley (t/Ha)	1.6	2	1.4	1.1
Lupins (t/Ha)	0.7	0.8	0.6	0.5
Chick Peas (t/Ha)	0.4	0.5	0.4	0.2
Canola (t/Ha)	0.6	0.7	0.6	0.5
Crop Cost Analysis				
Seed & Treatment ($/Crop Ha)	3	4	3	3
Crop Insurance ($/Crop Ha)	2	2	2	2
Pesticides and Herbicides ($/Crop Ha)	36	39	35	36
Fertiliser ($/Crop Ha)	49	49	49	47
Fuel & Oil ($/Crop Ha)	20	17	21	22
Repairs & Maintenance ($/Crop Ha)	21	23	20	22
Paid Labour ($/Crop Ha)	9	8	9	6
Total Crop Costs ($/Crop Ha)	127	138	123	121
Sheep Production				
Winter Grazed Hectares (Ha)	1095	975	1137	1154
Total Sheep Shorn (Head)	2892	2555	3047	2421
Total Sheep Income ($/WGHa)	72	93	65	56
Sheep Costs ($/WGHa)	51	52	51	52
Wool Cut (Kg/Head)	4.41	4.65	4.3	4.51
Wool Cut (Kg/WGHa)	12.13	11.67	12.34	9.88
Wool Price ($/Kg)	3.98	4.55	3.72	3.57
Average Sheep Sale Price ($/Head)	38	37	38	41
Lambing Rate %	82%	83%	82%	82%
NUMBER OF FARMS SURVEYED	46	12	34	12

Carnamah - Comparative Analysis of District Performance

	Average	Top 25%	Other 75%	Low 25%
Capital Analysis				
Effective Area (Ha)	3022	2097	3306	3565
Assets ($/Eff Ha)	1401	1517	1365	1663
Debt ($/Eff Ha)	219	303	193	288
Long Term Debt ($/Eff Ha)	158	221	139	231
Equity (%)	84%	78%	86%	83%
Long Term Debt to Income (%)	49%	55%	47%	74%
Return to Capital	6%	14%	4%	-3%
Machinery Value ($/Eff Ha)	247	211	258	327
Rainfall (mm)	236	224	240	219
Operating Analysis				
Farm Income ($/Eff Ha)	257	316	238	204
Operating Costs ($/Eff Ha)	153	135	158	186
Operating Return ($/Eff Ha)	104	181	80	18
Operating Profit ($/Eff Ha)	79	160	55	-15
Operating Cost/Farm Income (%)	64%	43%	70%	98%
Grain % of Farm Income	86%	89%	85%	79%
Sheep & Wool % of Farm Income	11%	9%	12%	18%
Operating Costs				
Seed & Treatments ($/Eff Ha)	5	3	6	7
Crop Insurance ($/Eff Ha)	2	2	1	2
Pesticides/Herbicides ($/Eff Ha)	27	21	29	35
Fertiliser ($/Eff Ha)	40	38	40	46
Contract ($/Eff Ha)	6	4	6	3
Fuel & Oil ($/Eff Ha)	15	13	16	20
Repairs & Maintenance ($/Eff Ha)	13	11	14	18
Conservation ($/Eff Ha)	1	0	1	1
Repairs BFW ($/Eff Ha)	3	2	4	4
Paid Labour ($/Eff Ha)	7	2	8	15
Overhead Costs				
Rates ($/Eff Ha)	5	5	5	6
Licences ($/Eff Ha)	2	1	2	3
General Insurances ($/Eff Ha)	4	3	4	6
Professional Fees ($/Eff Ha)	4	5	4	5
Telephone & Electricity ($/Eff Ha)	2	3	2	3
Overhead Costs Sub Total ($/Eff Ha)	19	18	20	27
Other Costs				
Total Personal Expenditure ($/Eff Ha)	27	41	23	25
Taxation ($/Eff Ha)	2	5	1	2
Loan Repayments ($/Eff Ha)	10	7	11	15
Hire Purchase & Lease ($/Eff Ha)	19	11	22	29
Capital Expenditure ($/Eff Ha)	60	115	43	42
Interest on Loans ($/Eff Ha)	12	12	11	12

Cropping Analysis				
Total Crop Area (Ha)	2078	1467	2266	2518
Crop % of Effective Area (%)	68%	66%	69%	79%
Machinery Value ($/Crop Ha)	358	319	369	427
Crop Yields				
Wheat (t/Ha)	2.2	2.2	2.2	2.1
Barley (t/Ha)	2.2	3.6	2	1.9
Lupins (t/Ha)	1	1	1	0.9
Chick Peas (t/Ha)	0.6	0.6	#DIV/0!	#DIV/0!
Canola (t/Ha)	0.6	#DIV/0!	0.6	0.5
Crop Cost Analysis				
Seed & Treatment ($/Crop Ha)	7	5	8	8
Crop Insurance ($/Crop Ha)	2	3	2	3
Pesticides and Herbicides ($/Crop Ha)	40	32	43	46
Fertiliser ($/Crop Ha)	59	59	59	63
Fuel & Oil ($/Crop Ha)	23	20	24	27
Repairs & Maintenance ($/Crop Ha)	20	17	20	24
Paid Labour ($/Crop Ha)	10	2	12	20
Total Crop Costs ($/Crop Ha)	155	143	159	163
Sheep Production				
Winter Grazed Hectares (Ha)	944	631	1040	1047
Total Sheep Shorn (Head)	2270	1249	2679	2100
Total Sheep Income ($/WGHa)	69	83	65	98
Sheep Costs ($/WGHa)	44	43	45	69
Wool Cut (Kg/Head)	6.28	4.76	6.89	5.05
Wool Cut (Kg/WGHa)	13.06	11.35	13.82	19.21
Wool Price ($/Kg)	3.23	3.67	3.06	3.82
Average Sheep Sale Price ($/Head)	50	56	48	28
Lambing Rate %	71%	80%	68%	59%
Number of Farms Surveyed	17	4	13	4

Comments: ***These results have been extracted from the 'BankWest Benchmarks 2001-2002' report***. For more information please contact the BankWest Agribusiness Centre on (08) 94205174 or Mark Norton, BankWest Manager Dalwallinu on (08) 9661 1101.

Also, if anyone who has not previously participated and would like to, please contact Mark for details. This enables the database to be expanded improving the accuracy of the information. You will also receive a report comparing your own data to the district data as soon as it is extracted.